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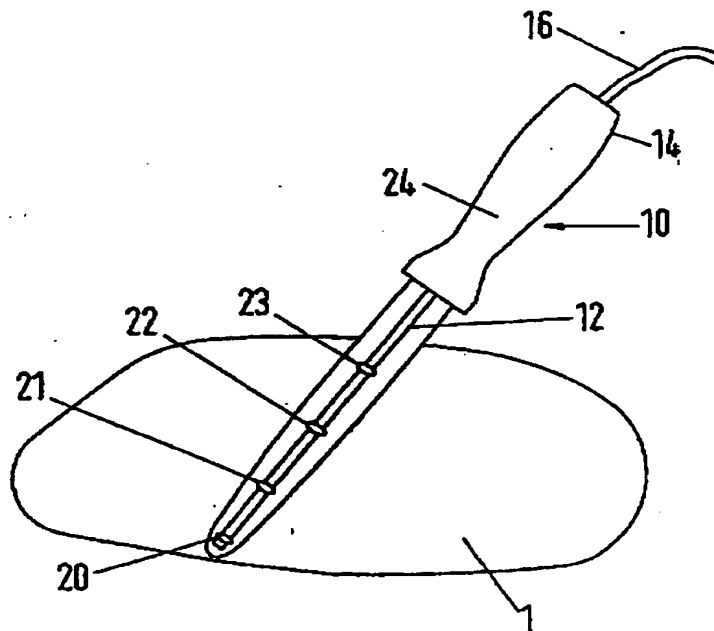
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(54) Abstract Title

Temperature sensor for controlling a cooking process

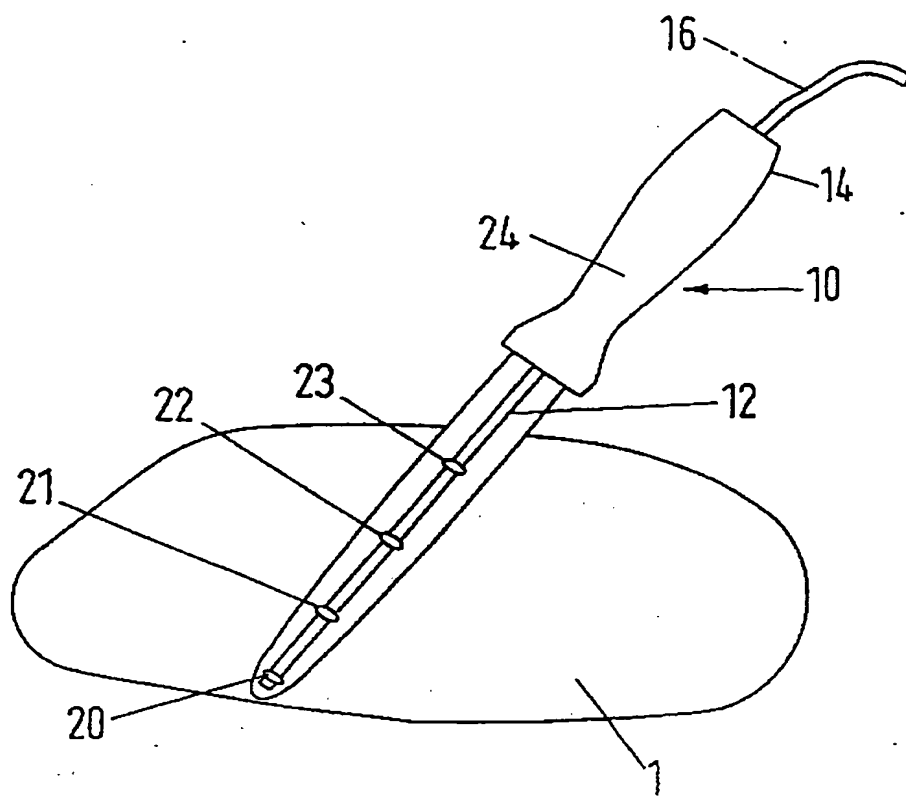
(57) A method of controlling a cooking process uses a cooking process sensor 10 which is inserted in a food item 1. At least two temperature values inside the food are registered from temperature sensors 20, 21, 22, 23. Temperature is also measured outside the food using a sensor 24 in the handle 10. This information is conveyed electrically through a cable 16 to a process controller and is used to control the cooking process.



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**A METHOD OF CONTROLLING A COOKING PROCESS
AND A COOKING PROCESS SENSOR FOR USE WITH
THE METHOD.**

The instant invention relates to a method of controlling a cooking process. More particularly, the invention relates to a method of controlling a cooking process in response to at least two temperature values picked up by a cooking process sensor which is adapted to be stuck at least partly into food to be cooked. The instant invention also relates to a cooking process sensor to be used with a method specified.

A method of the generic kind defined above is known, for instance, from DE 31 19 496 A1. With this known method a food thermometer is used which comprises a lance-like sensor portion, useful for temperature control, being equipped with a plurality of temperature sensors and adapted to be stuck into food to be cooked. The known food thermometer is electrically connected to an evaluating means so that the output of a microwave source is reduced gradually via process control when a certain temperature threshold value, preferably a maximum value per temperature sensor is reached. It is a disadvantage of the known method that its range of application is very limited in view of the fact that merely threshold temperature values are relied upon for stepwise controlling of the cooking process.

It is an object of the present invention to provide an improved method of controlling a cooking process.

It is another object of the present invention to provide an improved cooking process sensor.

According to one aspect of the present invention, there is provided a method of controlling a cooking process in response to at least two temperature values picked up by a cooking process sensor adapted to be stuck at least partly into food to be cooked, wherein specific parameters of cooking food and/or cooking utensils are determined via the thermo-kinetics of the temperature values registered, and the specific cooking food and/or cooking utensil parameters determined are utilized for controlling the cooking process.

The object is met, in accordance with the invention, in that specific parameters of cooking food and/or cooking utensils are determined via the thermo-kinetics of the temperature values registered, and the specific cooking food and/or cooking utensil parameters determined are utilized for controlling the cooking process.

Provision may be made for having the cooking process sensor detect a plurality of temperature values, preferably four, at various depths of penetration inside the cooking food and at least one more temperature value outside of the cooking food, preferably at the surface of the cooking food, and for using these values to control the cooking process.

Furthermore, it is proposed to register at least one moisture value in and/or at the cooking food by means of the cooling process sensor and draw upon it, for controlling the cooking process.

It is likewise proposed that the flow of air at least at the cooking food be registered by the cooking process sensor and relied upon for controlling the cooking process.

Moreover, it is proposed that differential temperature values and/or differential moisture values between sensors arranged spaced apart along the direction of penetration of the cooking process sensor be detected and drawn upon for controlling the cooking process.

A further development of an embodiment of the invention is characterized in that the core temperature of the cooking food, the placement of the cooking process sensor in the cooking food, especially with respect to the core point of the cooking food, the diameter of the cooking food, the density of the cooking food, the type of cooking food, the degree of ripeness of the cooking food, the pH of the cooking food, the consistency of the cooking food, the storage condition of the cooking food, the smell of the cooking food, the taste of the cooking food, the quality of the cooking food, the browning of the cooking food, the crust forming of the cooking food, the vitamin decomposition of the cooking food, the formation of carcinogenic substances in the cooking food, the hygiene of the cooking food, and/or the heat conductivity of the cooking food is/are determined as specific cooking food parameters, preferably by extrapolation or iteration of the values registered by the cooking process sensor.

It is also proposed to determine as cooking utensil parameters the power, the amount of air circulated, the energy consumption, the charge, the specific performance and/or the load:power ratio of a cooking utensil, preferably by extrapolation or iteration of the values registered by the cooking process sensor.

An embodiment of the invention is characterized in that the temperature values, the differential temperature values, the moisture values, the differential moisture values, and/or the air flow values registered are supplied by the cooking process sensor to a control means for a heater element, a cooling element, a ventilator, a means for introducing moisture into the cooking space, a means for discharging moisture from the cooking space, a means for supplying energy, and/or a means for dissipating energy, especially for controlling the course of the cooking process and/or achieving a set cooking result.

It is further proposed that the temperature values, the differential temperature values, the moisture values, the differential moisture values, and/or the air flow values registered by the cooking process sensor be utilized for controlling the temperature course, the moisture content, the air flow, the defined parameters of the cooking food and/or cooking utensils.

It may also be provided that the water activity, the moisture content, and/or the protein content of the cooking food is/are determined by the cooking process sensor or supplied to an evaluating unit for the parameters obtained by the cooking process sensor.

According to another aspect of the present invention, there is provided, a cooking process sensor for use with a method according to the first aspect of the invention, the cooking process sensor comprising a tip equipped with at

least two sensors and to be introduced at least partly into cooking food, preferably by means of a handle.

It may be provided for the tip to comprise at least four temperature sensors and at least one temperature sensor to be provided at the handle.

A preferred further development is characterized by comprising at least one other sensor unit adapted to be fixed or fixed in the cooking space.

Moreover, an evaluating and/or control unit, preferably in the form of a microprocessor may be provided in the cooking process sensor.

It is also suggested that the cooking process sensor comprise a cable or a transmitter and receiver unit, including power supply.

In cooking, the method of the instant invention permits accurate determination particularly of the core temperature of food to be cooked, based on the kinematics, i.e. the course in time, of temperature values registered inside the cooking food by means of a cooking process sensor. This is possible even if cooking process sensors should not be positioned very accurately. Therefore, not only are better results obtainable but also results which are better reproducible since the cooking programs are controlled by core temperatures. Furthermore, the duration of core temperature controlled cooking programs can be predetermined more precisely. The exact determination of a core temperature also makes it possible to provide a meaningful hygiene indication.

Other climatic parameters, such a moisture values, differential moisture values, and/or air flow values likewise can be picked up according to the

invention so that it can be prevented that the surface of the cooking food dries out. On the contrary, the cooking food will result uniformly done, having the desired browning, color, consistency, and hygiene at the end of the cooking process. This means that standardized cooking quality can be warranted.

In particular, cost and energy can be saved in the course of a cooking process according to the invention by virtue of the values recorded by means of the cooking process sensor as the air flow required, the specific performance, and the like can be minimized.

Further features and advantages of the invention will become apparent from the following description of an embodiment according to the invention illustrated by way of example in the accompanying single diagrammatic figure which is a perspective view of an intelligent cooking process sensor according to the invention, shown introduced into food to be cooked.

As may be taken from the drawing, an intelligent cooking process sensor according to the invention in the form of a temperature sensor 10, for instance, comprises a tip 12, a handle 14, and a cable 16, the tip 12 being adapted to be inserted in cooking food 1. Moreover, there are four temperature sensor elements or units 20, 21, 22, 23 disposed in the area of the tip 12 and serving to detect the temperature in the cooking food, while there is another temperature sensor element or unit 24 inside the handle 14 to detect the temperature at the cooking food 1.

An evaluating unit for the (differential) temperature values to be registered is integrated in the temperature sensor 10 according to the invention. This evaluating unit in turn is connected to a process controller (not shown) for a cooking utensil. The temperature sensor 10 according to the invention is

useful for providing more than one value of temperature within the cooking food 1 and another value of temperature prevailing at the cooking food 1. Consequently, the thermo-kinetics of the (differential) temperature values obtained by means of the temperature sensors 20 to 24 may be relied upon for determining especially the actual core temperature of the cooking food 1, such as by extrapolation. The exact core temperature thus determined may then be utilized for controlling the cooking process.

In addition to the core temperature, the heat transfer into or to the cooking food 1 from a heater element (not shown) arranged in the cooking space also may be detected and used, for example, to control a fan (not shown). The course over time of the core temperature, determined on the basis of the (differential) temperature values detected, may be drawn upon in order to find out the load:power ratio during cooking, among others for determining the cross section of the cooking food.

The features of the invention disclosed in the above specification, in the drawings and claims may be essential both individually and in any desired combination for implementing the invention in its various embodiments.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

List of reference numerals

- 1. Cooking food
- 10. Temperature sensor
- 12. Tip
- 14. Handle
- 16. Cable
- 20. to 24. Temperature sensor elements

CLAIMS:

1. A method of controlling a cooking process in response to at least two temperature values picked up by a cooking process sensor adapted to be stuck at least partly into food to be cooked, wherein specific parameters of cooking food and/or cooking utensils are determined via the thermo-kinetics of the temperature values registered, and the specific cooking food and/or cooking utensil parameters determined are utilized for controlling the cooking process.
2. The method as claimed in claim 1, characterized in that a plurality of temperature values, preferably four, are detected by the cooking process sensor within the cooking food at different depths of penetration, and at least one other temperature value is detected outside of the cooking food, preferably at the cooking food surface, and they are drawn upon for control of the cooking process.
3. The method as claimed in claim 1 or 2, characterized in that at least one moisture value is registered by the cooking process sensor in and/or at the cooking food and drawn upon for controlling the cooking process.
4. The method as claimed in any one of the preceding claims, characterized in that the air flow at least at the cooking food is registered by the cooking process sensor and drawn upon for controlling the cooking process.
5. The method as claimed in any one of the preceding claims, characterized in that differential temperature values and/or differential moisture values between sensors arranged spaced apart along the direction of penetration of the

cooking process sensor are detected and drawn upon for controlling the cooking process.

6. The method as claimed in any one of the preceding claims, characterized in that the core temperature of the cooking food, the placement of the cooking process sensor in the cooking food, especially with respect to the core point of the cooking food, the diameter of the cooking food, the density of the cooking food, the type of cooking food, the degree of ripeness of the cooking food, the pH of the cooking food, the consistency of the cooking food, the storage condition of the cooking food, the smell of the cooking food, the taste of the cooking food, the quality of the cooking food, the browning of the cooking food, the crust forming of the cooking food, the vitamin decomposition of the cooking food, the formation of carcinogenic substances in the cooking food, the hygiene of the cooking food, and/or the heat conductivity of the cooking food is/are determined as specific cooking food parameters, preferably by extrapolation or iteration of the values registered by the cooking process sensor.

7. The method as claimed in any one of the preceding claims, characterized in that the power, the amount of air circulated, the energy consumption, the charge, the specific performance and/or the load:power ratio of a cooking utensil is/are determined as cooking utensil parameters, preferably by extrapolation or iteration of the values registered by the cooking process sensor.

8. The method as claimed in any one of the preceding claims, characterized in that the temperature values, the differential temperature values, the moisture values, the differential moisture values, and/or the air flow values registered are supplied by the cooking process sensor to a control means for a heater element, a cooling element, a ventilator, a means for introducing moisture into the cooking space, a means for discharging moisture from the cooking space, a

means for supplying energy, and/or a means for dissipating energy, especially for controlling the course of the cooking process and/or achieving a set cooking result.

9. The method as claimed in any one of the preceding claims, characterized in that the temperature values, the differential temperature values, the moisture values, the differential moisture values, and/or the air flow values registered by the cooking process sensor are utilized for controlling the temperature course, the moisture content, the air flow, the defined parameters of the cooking food and/or cooking utensils.

10. The method as claimed in any one of the preceding claims, characterized in that the water activity, the moisture content, and/or the protein content of the cooking food is/are determined by the cooking process sensor or supplied to an evaluating unit for the parameters obtained by the cooking process sensor.

11. A cooking process sensor (10) for use with a method as claimed in any one of the preceding claims, comprising a tip (12) equipped with at least two sensors (20, 21, 22, 23) and to be introduced at least partly into cooking food (1), preferably by means of a handle (14).

12. The cooking process sensor as claimed in claim 11, characterized in that at least four temperature sensors (20, 21, 22, 23) are provided at the tip (12) and at least one temperature sensor (24) is provided at the handle (14).

13. The cooking process sensor as claimed in claim 11 or 12, characterized by at least one other sensor unit adapted to be fixed or fixed in the cooking space.

14. The cooking process sensor as claimed in any one of claims 11 to 13, characterized by an evaluating and/or control unit, preferably in the form of a microprocessor.

15. The cooking process sensor as claimed in any one of claims 11 to 14, characterized by a cable (16) or a transmitter and receiver unit, including power supply.

16. A method of controlling a cooking process substantially as hereinbefore described with reference to the accompanying drawing.

17. A cooking process sensor substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

18. Any novel feature or combination of features disclosed herein.



INVESTOR IN PEOPLE

Application No: GB 0022958.3
Claims searched: 1 to 18

13

Examiner: Jane Croucher
Date of search: 19 February 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.S): G1N (NADCF, NADCR, NADCT, NAFB, NARA), H5H (HMCR)
Int Cl (Ed.7): F24C7/08, H05B6/68, G01K1/02, G01K13/00 and G01K13/10
Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, Y	WO 93/16333 A1	AKTIEBOLAGET (see page 1, lines 26-34, page 2 lines 1-3 and 36-38, and figure 1)	X: 1, 2, 5, 8, 9, 11, 14, 15 Y: 3, 10
Y	DE 3938823 A1	MIELE (see claims 1 and 2 and figure 2)	3, 10
X, Y	DE 3119496 A1	BOSCH-SIEMENS (see claims 1, 2 and 4 and figures 2 and 3)	X: 1, 2, 5, 8, 9, 11, 13, 14, 15 Y: 3, 10
X	JP 58099623 A	MATSUSHITA (see abstract and figures 2 and 3)	1, 5, 8, 9, 11, 14, 15

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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